Anomalous transverse distribution of pions as a signal for disoriented chiral condensates*

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We give evidence that the production of DCC'S during a non-equilibrium phase transition can lead to an anomalous transverse distribution of secondary pions when compared to a more conventional boost invariant hydrodynamic flow in local thermal equilibrium. Our results pertain to the linear ð model, treated in leading order in large-N, in a boost invariant approximation

In this work we see that a non-equilibrium phase transition taking place during a time evolving quark-gluon or hadronic plasma can lead to an enhancement of the low transverse momentum distribution. In particular, if a Centauro type event is not accompanied by such an enhancement one would be suspicious of ascribing this event to the production of disoriented chiral condensates as a result of a rapid quench.

Transverse expansion and direct pion-pion collisions are two competing effects that might change the degree of enhancement. The inclusion of transverse expansion might lead to amplification of the low momenta modes. On the other hand in the mean field approximation the pions can interact with the mean fields (DCC) via the auxiliary field x but do not interact directly with each other. Direct pion-pion collisions will tend to thermalize the system, and reduce the amplification of the unstable low momentum modes. This effect is included only in the next to leading order term of the 1/N expansion, and we plan to incorporate it in a future work.

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Symmetry breaking in $\lambda\phi^4$ theory*

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The time evolution of O(N) symmetric lambda Φ^4 scalar field theory is studied in the large N limit. In this limit the $< \Phi >$ mean field and two-point correlation function $< \Phi\Phi >$ evolve together as a self-consistent closed Hamiltonian system, characterized by a Gaussian density matrix. The static part of the effective Hamiltonian defines the True Effective Potential U_{eff} for configurations far from thermal equilibrium. Numerically solving the time evolution equations for energy densities corresponding to a quench in the unstable spinodal region, we find results quite different from what might be inferred from the equilibrium free energy "effective" potential F. Typical time evolutions show effectively irreversible energy flow from the coherent mean fields to the quantum fluctuating modes, due to the creation of massless Goldstone bosons near threshold. The plasma frequency and collisionless damping rate of the mean fields are calculated in terms of the particle number density by a linear response analysis and compared with the numerical results. Dephasing of the fluctuations leads also to the growth of an effective entropy and the transition from quantum to classical behavior of the ensemble. In addition to casting some light on fundamental issues of nonequilibrium quantum statistical mechanics, the general framework presented in this work may be applied to a study of the dynamics of second order phase transitions in a wide variety of Landau-Ginsburg systems described by a scalar order parameter.

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